PTO 07-6404

CC=DE DATE=19990401 KIND=U1
PN=29820742

SENSOR
[SENSOR]

DIETER HEINZ RIEGER, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. August 2007

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(19):	DE
DOCUMENT NUMBER	(11):	29820742
DOCUMENT KIND	(12):	U1
PUBLICATION DATE	(43):	19990401
APPLICATION NUMBER	(21):	29820742.7
DATE OF FILING	(22):	19981120
ADDITION TO	(61):	NA
INTERNATIONAL CLASSIFICATION	(51):	G01V 8/10
PRIORITY	(30):	NA
INVENTORS	(72):	NA
APPLICANT	(71):	RIEGER, DIETER HEINZ; WARTNIG, ANDREAS; SPRINGER, UWE.
DESIGNATED CONTRACTING STATES	(81):	NA
TITLE	(54):	SENSOR
FOREIGN TITLE	[54A]:	SENSOR

ADDITIONAL SHEET FOR REQUESTING A UTILITY MODEL DOCUMENT

Applicants:

1. RIEGER, Dieter Heinz
Maria-Krüger-Str. 75
D-28239 Bremen

2. WARTNIG, Andreas
Am Westerfeld 41
D-28832 Achim

3. SPRINGER, Uwe
Neuer Weg 77
D-28816 Stuhr

/1*

1. Dieter Heinz Rieger, Maria-Krüger-Str. 75, 28239 Bremen
2. Andreas Wartnig, Am Westerfeld 41, 28832 Achim
3. Uwe Springer, Neuer Weg 77, 28816 Stuhr

Sensor

The present invention relates to a sensor for detecting an object, especially a workpiece, with a sender mounted on the first leg of a base element for sending a scanning signal and a receiver mounted on a second leg of the base element for receiving the scanning signal, whereby the object can be brought into a detection area of the sensor between sender and receiver to interrupt the scanning signal.

Known sensors of this type are used for recognition or determination of a specific position of an object like a workpiece that, for example, is machined in a machine tool. With the use of an intermittently interrupted signal provided by the sensor, for example the machine tool, transport means like a conveyor belt or a workpiece gripper can be controlled.

A known sensor is designed as a type of photoelectric barrier, in

* Numbers in the margin indicate pagination in the foreign text.

which the source is arranged in the form of a light source for emitting a light beam on one leg, while the receiver is arranged as a light-sensitive photoelectric element on a leg lying opposite that is also longish for receiving the light beam emitted from the light source.

The two longish legs are arranged parallel and at a distance /2 from each other and the sender and/or receiver is positioned on opposite sides on the end sections of the two legs. Together with a base element, the two legs exhibit a U-shape or a fork shape. If an object like a workpiece goes between the two legs and in the connecting line between sender and receiver, the light beam - as a scanning signal - is interrupted by the work piece and a corresponding electrical signal is prepared by the sensor, which can be transferred to a control device. With the known sensor, the work piece can be brought into the scanning area arranged between the legs and guided out laterally or in the direction of the legs.

However, it has been found in practice that a fork-shaped sensor of this type is disadvantageous in some applications. Because of the fork or U-shape, the work piece can only be brought into the scanning area from the three sides, namely through an opening that is perpendicular and essentially parallel to the parallel legs. Because of the distance between the two legs, the scanning area and thus the size of an object to be detected is geometrically limited; an object that is e.g. thicker than the space between the two legs can not be scanned with a sensor of a specific size. Instead of this, a sensor with a larger distance between the two legs would have to be used. In addition, the objects to be recognized can possibly execute uncontrolled movements in certain applications; in

the case of larger pieces of sheet metal to be machined, these can be brought into oscillation with great excursions which can lead to a case in which the pieces of sheet metal in the scanning area bump against one or both legs which can result in damage to or even destruction of the sensor.

Thus the object of the present invention is to provide a sensor of the type named at the beginning, which prevents the disadvantages of the state of the art and can be used in more ways and is more robust.

The invention achieves this object with a sensor of the type named at the beginning, in that the first leg and the second leg are arranged at an angle to each other.

Because of the angled arrangement of the two legs of the sensor with respect to each other, for example, a work piece can be brought /3 into the scanning area from an addition direction in comparison to the known fork sensor. With suitable selection of the leg lengths and the angle formed between the legs, a workpiece can be brought into the scanning area, e.g. "from above," i.e. perpendicular to one extension direction of a leg, which was not possible with the known sensor. According to the invention, a scanning area or scanning space that opens at an angle results, into which a tool can be lowered and thereby interrupt the scanning signal. The scanning signal runs at an acute angle relative to the two legs.

In a preferred embodiment of the invention, it is provided that the first leg and the second leg are arranged at an angle of approx. 90° or a larger angle with respect to each other. With an arrangement of the legs such as this, especially at a right angle to each other, a scanning

area that is open from four directions results for the workpiece so the sensor can be used more flexibly and no component structures are present that interfere with scanning.

In a preferred embodiment, in which the first leg, the second leg and the connecting line between sender and receiver essentially form a triangle, the advantages according to the invention can be achieved easily. Preferably, sender and receiver are each arranged on an end section of the first or second leg.

In another preferred embodiment, it is provided that the sender and the receiver are essentially arranged in recesses formed in the base element so sender and receiver are protected from contact with a work piece and are thus secure against damage.

In an effective manner, on the legs essentially flat contact surfaces are formed for limiting the scanning area and contact area of an object, which preferably have a relatively hard surface to protect against damage due to impacts with the workpiece that may occur.

Also in a preferred manner, on the base element a housing is arranged to hold an electronic evaluation device so that overall a compact sensor results, which in a simple manner can be mounted on a machine tool, a robot, a handling device or the like. /4

According to a further development of this embodiment, it is provided that the housing is closed by at least one cover that can be fastened on the base element so that it can be removed or not so that the electronic evaluation device is protects. Simple manufacturing capability can be implemented in that the base element is one piece and can be designed

as a cast part or as a machined part of aluminum, steel or plastic.

It is preferable that the sender is designed as a light source and the receiver as a light-sensitive photoelectric element. For example, the light source can emit laser light, infrared light or so-called cold light. Alternatively the sender can also be designed as a sound source or nozzle for creating a gas stream that is detected by a suitable sensor, e.g. a pressure sensor; the gas stream would be interrupted when an object is brought in and a corresponding signal or a signal interruption will be generated by the pressure sensor.

The invention further achieves the object with a sensor for recognizing an object, with a sender on a first leg of a base element for sending a scanning signal, a reflector mounted on a second leg of the base element for reflecting the scanning signal and a receiver mounted on the first leg of the base element for receiving the scanning signal reflected from the reflector, in which it is provided according to the invention that the first leg and the second leg are arranged at an angle to each other.

Also in this way, according to the invention, a sensor suitable for detecting an object that can be used flexibly is implemented with the previously described advantage. Advantageously, sender and receiver are arranged adjacent to each other on a sensor head, while the reflector is arranged on the other leg.

In the following, the invention will be described suing two exemplary embodiments of a sensor according to the invention with reference to the enclosed figures. In the drawings:

Fig. 1 shows a cross section representation of a sensor; /5

Fig. 2 shows a top view of the sensor from Fig. 1;

Fig. 3 shows an alternative exemplary embodiment of a sensor according to the invention in a cross section representation;

Fig. 4 shows a top view of the sensor shown in Fig. 3.

The sensor shown in Fig. 1 in cross section for detecting an object, especially a workpiece, has a base element 2 of a metal like aluminum. On the base element 2, a first leg 4 and a second leg 6 arranged at a right angle to first leg 4 are formed. In a way that is not shown, the legs 4 and 6 could also be arranged at a different angle to each other. In the end section of the leg 4, a projection 5 is designed that can also serve as a stop for an object.

A sender 8 in the form of a light source is mounted on one end section of the first leg 4 with a recess 10 arranged on the leg 4 so that a light beam and/or light bundle can be emitted along the dotted line 12. A receiver 14 is arranged within a recess 13 designed on one end section of the second leg 6. The receiver 14 is designed as a photoelectric element and is used to receive a scanning signal created by the sender 8 in the form of a light beam. The light beam emitted by the sender 8 meets the receiver 14 as shown by line 12. The light beam and/or the light bundle emitted along line 12 lies within a scanning area 16 of the sensor arranged between sender 8 and receiver 14, into which the object to be detected can be brought so that the scanning signal in the form of the light beam is interrupted. The scanning area 16 is defined by the flat contact surfaces 18, 20 formed by legs 4 and 6, at which the object may come to rest.

As the side view according to Fig. 1 shows, the first leg 4, the second leg 6 and the connecting line (line 12) between sender 8 and receiver 14 essentially form a triangle; the connecting line is arranged at an angle to the legs 4 and 6. Because of the arrangement of the legs and of the sender 8 and receiver 14 on legs 4 and 6, respectively, an object in Fig. 1 can be brought both from above in the direction of arrow /6 22, say in the direction of another arrow 24 running essentially parallel to leg 6 or in a direction running perpendicular to the drawing plane into the scanning area 16 of the sensor, such that the scanning signal is interrupted by the entry of the object.

On base element 2 of the sensor, adjacent to leg 4, a housing 26 is formed for holding an electronic evaluation device 28, which is connected by means of electrical lines 30, 32 to the sender 8 and/or receiver 14 and by means of another line 34 coming out of the housing 26 to a control device, e.g. of a machine tool, in order to be able to transfer a signal to the control device that gives information on whether a workpiece is in the scanning area 16, more precisely in the area of line 12 along which the light beam runs or not. The line 32 is routed within a recess arranged in the leg 6. In completely assembled state, the evaluation device 28 can be fastened inside housing 26 with an embedding compound.

The exemplary embodiment shown in Figs. 3 and 4 is designed essentially identical to the exemplary embodiment described previously using Figs. 1 and 2 so that to avoid repetitions, reference is made to the explanations above. The reference numbers used in Figs. 3 and 4 are

identical to those in Figs. 1 and 2. The exemplary embodiment shown in Figs. 3 and 4 differs from the one previously described in that no projection 5 is formed on the end section of the leg 4, rather the straight-line contour of the contact surface 18 in the side view according to Fig. 3 is completely flat and straight.

In a way that is not shown, according to another exemplary embodiment, the sender 10 [sic] and receiver 14 can be combined adjacent to each other in a sensor head arranged in a recess 10, while instead of a receiver 14 arranged on the end section of leg 6, a reflector is provided there essentially on line 12 for reflecting the beam or the light emitted by the sender so that the beam or the light is sent be the sender, reflected by the reflector and then detected by the receiver or not if the beam is interrupted by an object brought into the scanning area 16.

Naturally, depending on the requirement and application case, /7 the sender 8 can be arranged on leg 6, preferably in recess 13 and the receiver 14 can be arranged on leg 4, preferably in the recess 10.

Reference number list

2	Base element
4	Leg
5	Projection
6	Leg
8	Sender
10	Recess
12	Line
13	Recess

14	Receiver
16	Scanning area
18	Contact surface
20	Contact surface
22	Arrow
24	Arrow
26	Housing
28	Evaluation device
30	Lines
32	Lines
34	Lines

Claims

1. Sensor for detecting an object, especially a workpiece with a sender arranged on a first leg (4) of a base element (2) for emitting a scanning signal and a receiver (14) arranged on a second leg (6) of the base element (2) for receiving the scanning signal, whereby the object can be brought into a scanning area (16) of the sensor arranged between sender (8) and receiver (14) for interrupting the scanning signal, characterized in that the first leg (4) and the second leg (6) are at an angle to each other.

2. Sensor according to Claim 1, characterized in that the first leg (4) and the second leg (6) are essentially arranged at an angle of about 90° or a larger angle with respect to each other.

3. Sensor according to Claim 1 or 2, characterized in that the first leg (4), the second leg (6) and a straight connecting line between sender (8) and receiver (14) essentially form a triangle.

4. Sensor according to one of Claims 1 to 3, characterized in that sender (8) and receiver (14) are each arranged on an end section of the first and second legs (4, 6), respectively.

5. Sensor according to at least one of the preceding claims, characterized in that the sender (8) and the receiver (14) are essentially arranged in recesses (10, 13) formed in the base element (2).

6. Sensor according to at least one of the preceding claims, characterized in that on legs (4, 6) essentially flat contact surfaces (18, 20) are formed to define the scanning area (16) and for contact of an object.

7. Sensor according to at least one of the preceding claims, /9 characterized in that on the base element (2), a housing (26) is mounted for holding an electronic evaluation device (28).

8. Sensor according to Claim 7, characterized in that the housing (26) is closed by at least one cover that can be fastened on the base element (2) so that it can be removed or not.

9. Sensor according to at least one of the preceding claims, characterized in that the base element (2) is one piece and designed as a cast part.

10. Sensor according to at least one of the preceding claims, characterized in that the sender (8) is designed as a light source and the receiver (14) is designed as a light-sensitive photoelectric element.

11. Sensor for recognizing an object, with a sender (8) arranged on a first leg (4) of a base element (2) for emitting a scanning signal, a reflector mounted on a second leg (6) of the base element (2) for reflecting the scanning signal and a receiver (14) arranged on the first leg (4) of the base element (2) for receiving the scanning signal reflected by the reflector, characterized in that the first leg (4) and the second leg (6) are arranged at an angle to each other.

12. Sensor according to Claim 11, characterized in that is designed according to one of the preceding Claims 2 to 10 with the feature that the sender (8) and receiver (14) are arranged adjacent to each other on a first leg (4) and the reflector is mounted on the second leg (6).

Fig. 1

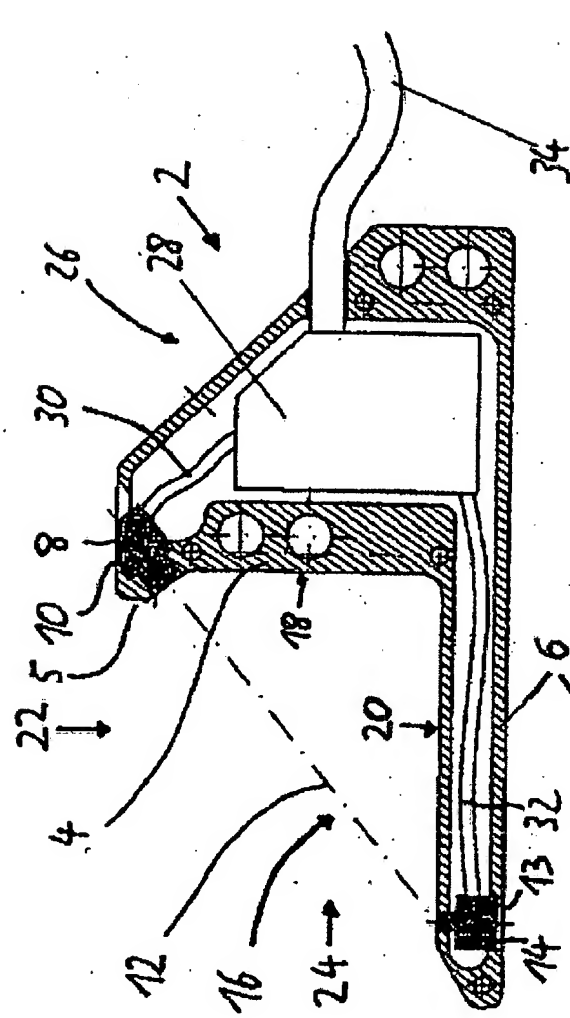

Fig. 2

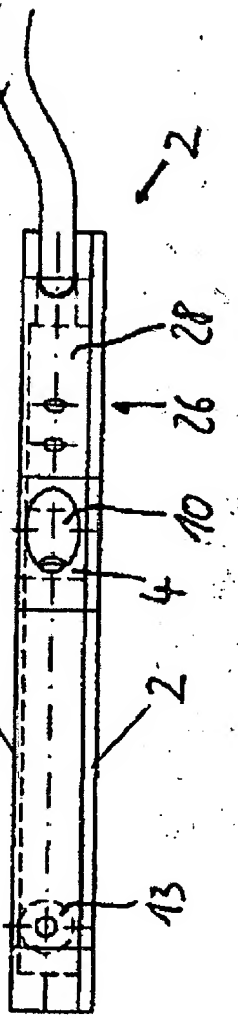

Fig. 3

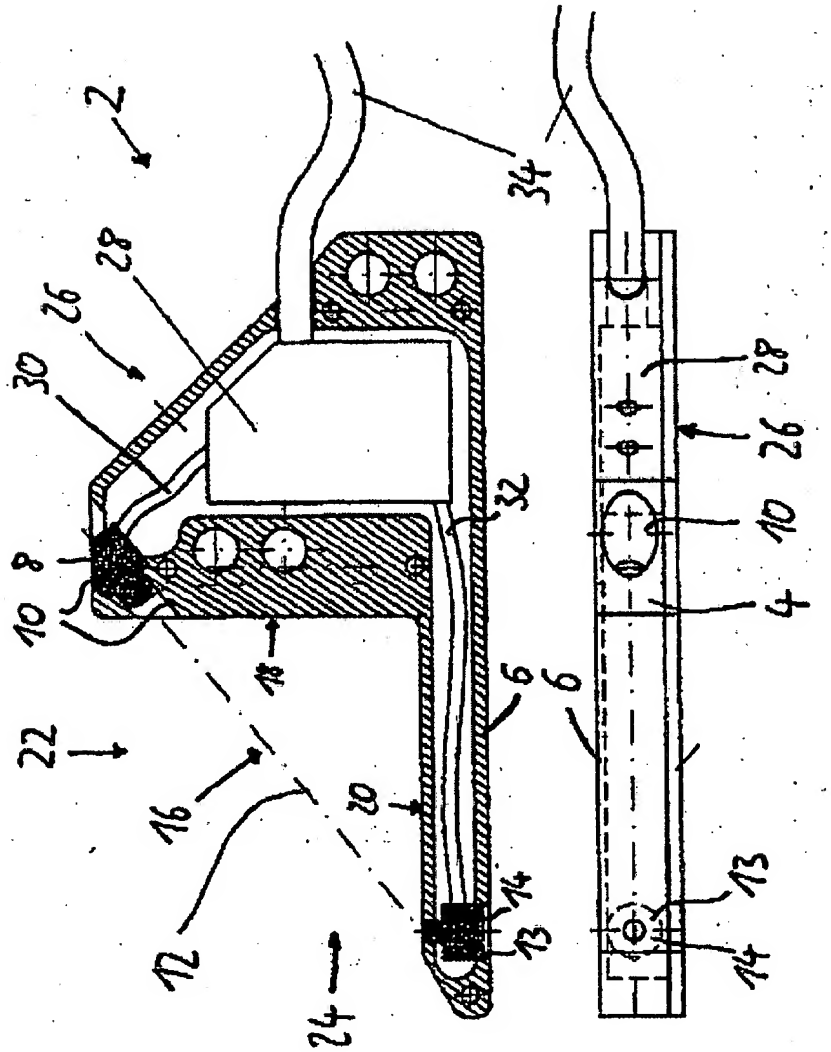

Fig. 4